AQUASCAPING AND WATERSCAPES AS AN UNDERWATER LANDSCAPE ART

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CONTENTS

O 9. AQUASCAPING AND WATERSCAPES AS AN UNDERWATER LANDSCAPE ART

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ABSTRACT: Forests, valleys, rivers, mountains are being destroyed by human activities and conventional nature landscapes are deteriorating. In the context of reinterpreting nature landscapes, aquascaping makes it possible to transport the longed-for nature landscapes between spaces. Aquascaping, which enables the introduction of aquatic plants and their placement in a composition outside their natural habitats, is an artistic activity that rises with the works of artists operating in different countries and develops under the name of the underwater design industry. The concept of aquascaping, evaluated within the scope of the study, aims to show that it is possible to make the underwater ecosystem sustainable in the indoor landscape. Within the scope of the study, the concept of aquascaping will be introduced as a concept that can be included in academic landscape education.

Keywords: Aquatic Plants, Aquascaping, Aquatic Plant Art

INTRODUCTION

Today, in cities where construction is increasing, people are stuck in closed spaces and their access to natural landscape areas is restricted. The pollution caused by intensive construction has caused the emergence of factors such as stress. The diminishing presence of green spaces in cities has revealed the need for individuals to shape their own environment. The potential benefits of living in harmony with nature for urban people have been researched by those working on environmental psychology, and it has been widely accepted in many environmental literatures that the association with nature has positive effects on human psychology (Özgüner, 2004). The transfer of the natural landscape to the interior, by ensuring the integration of the exterior with the interior, has revealed a description of the "green nature" image that people long for. The emergence of this image made possible the spatial transfer of natural materials such as stone as well as various plants. Individuals who apply their aesthetic values while shaping the interior have developed hobbies where they can create replicas of various natural landscape views. Aquascaping is among these hobbies, allowing people to reflect their aesthetic sensibility indoors.

1. WHAT IS AQUASCAPING?

The aesthetic value of a landscape is usually represented in the visual value of the landscape (Eroğlu and Başaran, 2017; Daniel and Boster, 1976). Visual landscape quality can also be defined as the relative aesthetic perfection of a landscape and can be measured by the taste of the observer (Kıroğlu, 2007). Allowing the representation of outdoor landscapes to be carried indoors, aquascaping makes it possible to use aquatic plants, which are important components of the aquatic ecosystem, with their aesthetic function as ornamental plants. In this context, the underwater landscape design art (perhaps related to the drop) has its roots in an old study. The aquarium principle, discovered by Robert Warington in 1850, was developed on the calculation that plants added to the water in a container could give enough oxygen to support animals if their numbers were not too large; this work has been accepted as the origin of the modern aquarium (URL 12). Aquascaping or underwater gardening, which aims to create a natural aquatic environment in the aquarium, is an aesthetic arrangement art in which materials such as rocks and stones are used together, if it is suitable for the chosen theme, as well as aquatic plants. In other

words, aquascaping, which creates the opportunity to experience gardening under water, also allows thematic gardens and landscapes to be exhibited indoors. Although Aquascaping is designed to create an underwater landscape created with artistic and aesthetic concerns, it requires technical maintenance. The maintenance of the tank in which plants and other materials are placed must be considered along with the technical aspects and growth requirements of aquatic plants. In the closed system of an aquarium tank, many factors need to be balanced to ensure an aquarium design is successful. These factors include filtration, keeping carbon dioxide at levels sufficient to support underwater photosynthesis, fertilization (may be chemistry), lighting, and algae control (James, 1986). Known as underwater landscape, aquascaping is evaluated by categorizing designs that enable different compositions to emerge. There are different water design styles that differ according to the type of aquatic plants used in the tank and their material preferences, each with spec ific characteristics.

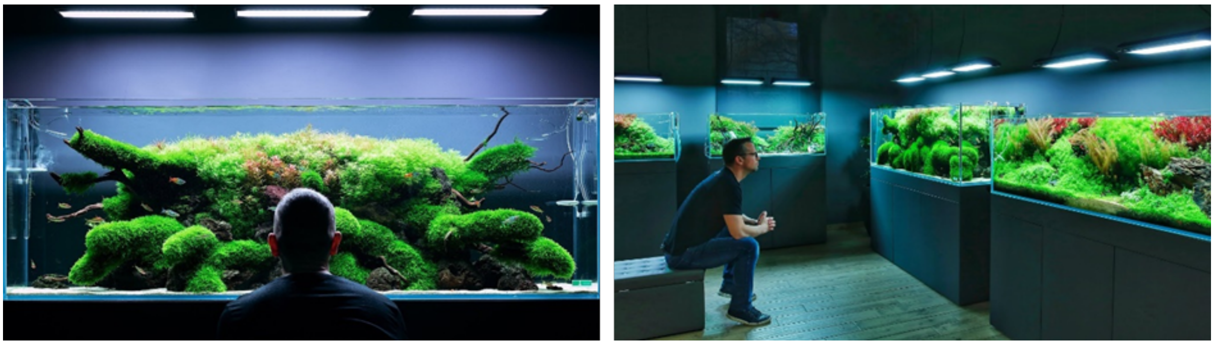


Figure 1. Aquascaping example (URL 12)

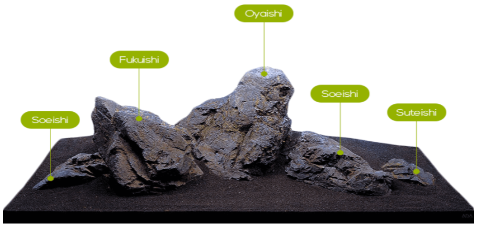
1.1. Aquatic Plants Used in Aquascaping Designs

All plants need water, which is the source of life. But some plants constantly live in water and have adapted to this life. Some plants, on the other hand, live in constantly wet soils along the waterfront (Gülgün et al., 2007). Aquatic plants, which are taken from their natural habitats and started to be used in underwater landscape designs, are placed in compositions where they can continue their development under artificial conditions. Aquatic plants, which help us create a space within the space and describe the scenes we are familiar with in nature, are also considered as design objects. The developing aquatic design industry has facilitated the introduction of aquatic plants, their circulation in the market and their delivery to aquarium designers. Thus, plants that are perhaps not known in their own habitat were introduced to the relevant people by being circulated in social media and made accessible.

Table 1. Aquascaping Designs and Plants Used

	Dutch aquarium example (Chun,2019).
	Popularized by the marketing of the first aquarium equipment in the Netherlands in the 1930s, this style of aquascape is entirely focused on growing and arranging aquatic plants (URL 2). The main focus in the Dutch style, which does not involve the use of any hard landscape materials such as driftwood, rock, or stone, is the height, color, and texture of a wide variety of aquatic plants. The basic placement technique in the tank is the terracing approach. The ability to apply this technique and create an aesthetically pleasing Dutch-style waterscape requires the aquarium designer to have a great deal of knowledge about different plants. Hygrophila, and red-leaved Alternanthera reineckii are used to provide texture and stepped structure, which is important in this style, and various Rotala species are used for accents. However, it is important that most of the aquarium floor is covered with plants. Some of the most used plant species in Dutch-style planted aquariums are

Saurus cernuus and Lobelia cardinalis, Hygrophila corymbos, Limnophila aquatica. In addition, species such as Alternanthera reineckii, Ammania, Rotala are preferred to create color accents and focal points. Java moss, on the other hand, is used to act as a surface cover to hide the materials placed in the design (URL 7).



Iwagumi style aquarium (Just,2012).

It is based on the design of a rock arrangement (hardscape). Only one to three types of aquatic plants are used (URL 1). In the Iwagumi style, which is also called rock garden, the use of dwarf plants is common. All about calm and zen feeling, the Iwagumi style offers a kind of waterscape inspired by the Japanese gardening style.Typical installation for an Iwagumi waterscape involves the use of three main stones. The largest of the three stones to be used is called Buddha; Two small stones called attention stones are added to complete the design (URL 1). Regardless of their number, each stone in the Iwagumi design has a name and a specific role it plays. Symmetry and balance are essential in the placement of stones. It is important to use stones of the same color and texture to create a sense of unity and harmony in the tank. Plants in an Iwagumi-style aquarium are limited, due to the demand to avoid plants blocking the stones and to focus on a more spacious and minimalistic aquarium. The most popular plants are small carpet plants such as Hemianthus callitrichoides Cuba, Eleocharis acicularis and parvula, Glossostigma elatinoides, Mikranthemum umbrosum Monte Carlo, Utricularia graminifolia.

Wild West, designed by Stjepan Erdeljić in a nature aquarium style (URL 4).

The nature aquarium style aims to create a landscape that resembles a landscape or image from the natural world. The most common nature aquarium waterscapes are designs that depict underwater versions of rainforests, mountains, slopes, beaches, or valleys. In the search for balance in the aquarium, both hardscape materials and plants play an important role to be selected according to the landscape to be depicted. Nature aquarium can be considered as the richest category in terms of landscape options that can be designed. In this category, where themes such as island, valley, slope, and mountain range can be designed, the use of plants also varies according to the selected landscape. Small-leaved plants such as Glossostigma elatinoides, Eleocharis acicularis, Eleocharis parvula, Echinodorus tenellus, Hemianthus callitrichoides, Riccia fluitans, and small water ferns, as well as Staurogyne repens and Java moss (Versicularia dubyana or Taxiphyllum).

Verve, designed in the style of Ryoboku. Chow Wai Sun. Hong Kong. 2011

This waterscape style is based on using wood as the main hardscape material. The word Ryoboku, which can be translated as "driftwood" in English, represents aquariums built with wood (URL 5). There are many types of trees that can be used in this style, including driftwood roots. Stones

of various structures and aquatic plants are also used in this design style, whose focus is on tree roots and woods. In the ryoboku style, Taxiphyllum barbieri or Java moss (Fig. 10) is preferred to cover woods and tree roots. Among the other aquatic plant species mainly used in this style are Taxiphyllum sp. aka peacock moss and Leptodictyum riparium or fibrous moss are examples (URL 8).

Forest or Jungle Style

Jungle-style waterscapes often feature hard materials with little or no visibility. Due to the density of plants, the aquarium has limited open space. Plants with thicker, coarser leaf shapes, such as Echinodorus bleheri; used to provide a wild, untamed look. Unlike nature style, forest style does not create clean lines or use fine textures (URL 6). The presence of dense plants reduces the light transmittance in the aquarium and provides a shaded environment. There is intensive use of plants in forest style. A forest canopy effect can be achieved by using combinations of darker substrates, tall plants that grow to the surface, and floating plants that block light and provide a variegated lighting effect (URL 6). Among the plants used in forest style waterscapes, there are species such as Microsorum pteropus as well as Bolbitis heudelotii, Vallisneria americana, Crinum, Aponogeton, Echinodorus, Sagittaria subulata, Hygrophila pinnatifida, Anubias.

1.2. Aquascaping as an Art and the Emerging Design Industry

Aquascaping term is often explained as underwater landscape gardening (Akshitha and Girwani, 2020). Underwater landscape gardening is considered as a form of art (Martin, 2013). It is often referred to as living art. Aquascaping is different from any other art form because it is so rich and diverse. Composition is the art of arranging all of the aquarium’s interior components such as wood, rocks, and plants, as well as the use of open space, light, and shade (Farmer, 2020). Colors and textures provide visual interest to an aquascape. Consider the colors of the hardscape and how it contrasts with the plants. Arranging the landscape elements in the aquarium according to the golden ratio is also considered extremely important.

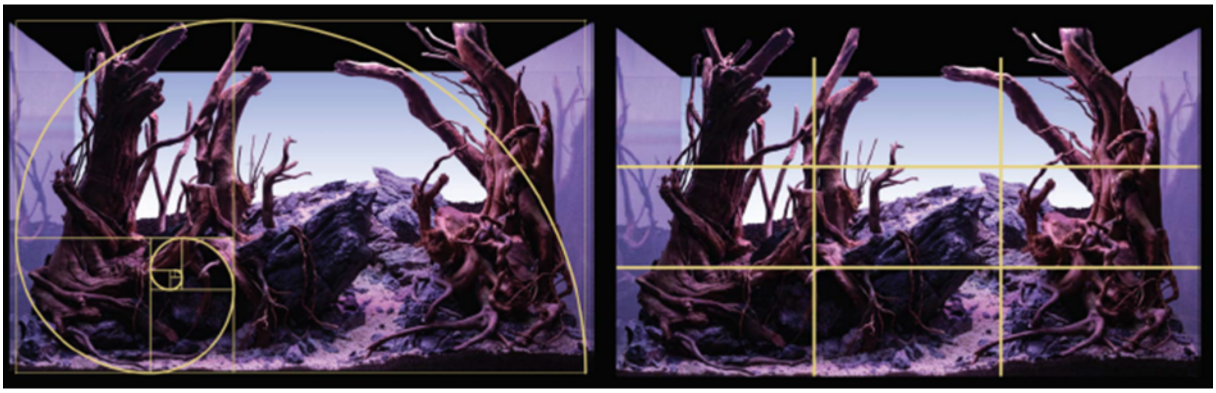


Figure 2. Golden Ratio of Aquascaping (Farmer,2020)

As with all art forms, aquascaping is subjective and in some respects. There is no style that’s better than another it’s a matter of taste and sensitivity. So, aquascaping brings science and art together. In this context, it has revealed underwater landscape designers who are dedicated to revealing living works of art and therefore these works. The developing underwater design industry has made it possible to display plants indoors by using them in various compositions. It ensures that the lost nature landscapes are

depicted and watched indoors and made sustainable. In this context, hundreds of people who unite around aquascaping participate in international competitions and share their designs. IAPLC (International Aquatic Plant Layout Competition) is an international planted aquarium competition in which participants compete with each other to create original "waterscapes" in the aquarium. Participants send a photograph of the water scenes they took during the year they are in, and the works sent from all over the world are evaluated by the jury members who are experts in the sector. The interest in the competition both promotes aquatic plants and confronts individuals with the destruction of nature through the designed landscapes. The total number of applications and the number of participating countries to the competition, which started in 2001 with 19 participating countries and a total of 557 works, is increasing every year. Currently, with more than 60 participating countries and a total number of applications close to 2,000, IAPLC is held as a worldwide competition (URL 10).

Figure 3. Forest Scent, Pavel Bautin. Russia. 2010 IAPLC Grand Prize Winner (URL 13)

There are also artists who play a pioneering role in representing aquascaping designs as exhibition objects or works of art. Takashi Amano, who was born in Niigata, Japan in 1954, is known as a Japanese landscape and landscape photographer (URL 11). Takashi Amano, the founder of Nature Aquarium and CEO of Aqua Design Amano Co., Ltd., is known as a name that seeks the source of designing waterscapes in nature aquariums in nature itself. The artist's observation site and the source of his designs are rainforests, known for their large rivers and aquatic plants.Visiting the tropical rainforests of the Amazon, Borneo, and West Africa and the pristine forests of Japan since 1975, Amano works with his large-format cameras on a series of photographs focusing on "pristine nature" and reinterprets the landscapes he captures in his photographs. Although only Takashi Amano is mentioned within the scope of this study, as he is considered a pioneer in the field, there are different artists who contribute to the development of the underwater design industry and continue their activities in different countries.

2. O_2 SOURCE FOR THE AQUARIUM

2.1. Aquatic plants and the effects of CO_2, O_2 and sunlight on the photosynthesis process

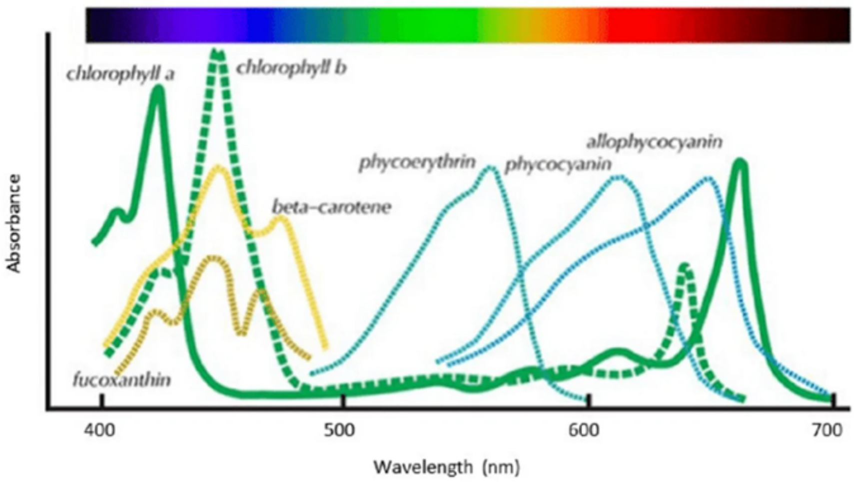
Photosynthesis is a chemical process that occurs in almost all plants, including aquatic plants. The ability of plants to perform photosynthesis depends on three basic nutrients such as carbon dioxide (CO2), water (H2O) and sunlight. Oxygen (O2), a by-product of the photosynthesis process, is one of the vital resources of life for humans and animals. Since, depending on the presence of algae, bacteria and plants that perform photosynthesis on the earth's surface, the air that people and living creatures breathe can be provided. Continuity of photosynthetic process is required to return and renew the oxygen needed in the Earth's biosphere. The first data on the photosynthetic process appear in primitive forms of algae and bacteria and date back many years (İşler, 2023).

The sun supports the abundance of oxygen in the water. Because algae and all aquatic plants in the water continue to perform photosynthesis owing to the sun's nourishing rays and provide plenty of oxygen to the water. In cloudy weather, this situation is reversed and the amount of oxygen in the water decreases significantly compared to sunny weather. Thus, when the sun, the basic nutrient of photosynthesis, is not available, photosynthetic plants, like other living things, evolve to consume oxygen in the air. In summary, whether it is an open system or a closed system such as an aquarium, all plants, including algae and aquatic plants, must benefit from sunlight at the maximum level in order to

provide the oxygen needs of all living things in the universe. As a result, the amount of oxygen in the universe remains balanced. In this context, appropriate lighting systems with wavelengths close to daylight should be used for aquatic plants used in a closed system such as an aquarium (Bakırcı, 2019).

In lighting systems, some important concepts can be listed as follows; for the light source Watt value (defined as the power drawn by the system from the power line), Lumen value (roughly expressed as the brightness of the light), Kelvin value (this value is 5800 Kelvin for the sun. While increasing of this value the color shifts to blue and its decreasing the color shifts to red. The value considered white is in the range of 6000-6500 Kelvin.), Photosynthetically Active Radiation (PAR) value (it represents the wavelength of light used by plants for the ideal photosynthesis process and corresponds to a wavelength of 400-700 nm), Photosynthetic Photon Flux (PPF) and Photosynthetic Photon Flux Density (PPFD) values (PPF expresses the flux of all photons released from the source in the PAR value region, while PPFD measures the value of PPF per unit. In briefly, PPF measures the amount of photosynthetic light coming out of the source, and PPFD measures the amount of photosynthetic light per area on the plant.), Daily Light Integral value (DIL) (it is the sum of the photosynthetic light per unit area in a 24-hour period and is a measure of how much photosynthetic light the plant receives.), Yield Photon Flux (YPF) value (this value is obtained by calculating the absorption coefficient at each wavelength and the values in the absorption spectrum, taking into account the plant's response to photosynthetic radiation at different wavelengths.). It should be noted that in lighting systems, indicators such as watts and lumens are not sufficient to understand the performance of the light, but values such as PAR, PPF and YPF have scientific meaning. In order to increase the PAR quality of the light and ensure homogeneous distribution of light in the system (light diffusion), a semi-permeable layer (white color) is placed in front of the light source to provide soft light and homogeneous illumination (Çağlayan, 2013).

The graph below shows the wavelengths corresponding to the absorption amount (absorbance) of some photosynthetic pigments. This graph expresses the percentage of absorption of 1 unit of light sent to the plant by the photosynthetic pigment and that plants respond differently under different lights due to pigment differences in their structures. As it is shown in the graph Chlorophyll A and chlorophyll B absorb blue light more than other regions, while phycoerythrin absorbs green light and allophycocyanin absorbs red light more than other regions (Kayalı, 2022).



Graph 1. Wavelengths corresponding to the absorption amount (absorbance) of some photosynthetic pigments (Kayalı, 2022).

On the other hand, growing a plant using only blue-light or only red-light sources may create differences in the morphological structure of that plant. In addition, it should not be forgotten that used different light colors may have different morphological effects on different plants and that the higher absorption of any color is not meaningful in terms of plant photosynthesis (Dalkılıç, 2018).

The decrease in the amount of dissolved oxygen in surface waters disrupts the water quality of life and creates cultural eutrophication, which supports the formation of odors and bacteria and causes the death of fish. Therefore, necessary precautions must be taken to prevent algae and aquatic plants from deteriorating the quality of the water in their environment. Namely, since the basic nutrients of

algae and aquatic plants are CO_2, nitrogen (N_2) and phosphorus (P), unbalanced and excessive use of these nutrients causes uncontrolled proliferation of algae and aquatic plants, which are fatal to living things. Similarly, if N/P and CO_2/O_2 ratios are not kept balanced in aquarium systems, water quality will deteriorate due to uncontrolled plant growth and the resulting proliferation of microorganisms and bacteria in the aquarium. Therefore, eutrophication is inevitable in a closed system, too. Appropriate amounts of N and P fertilization should be made for aquatic plants used in the aquarium system, N/P ratios should be adjusted, and photosynthesis should be provided for the plant with enough daylight. In this way, the amount of dissolved oxygen in the water is increased and the quality of life for fish and living things is preserved. As a result, in aquarium systems, the nutrients amount of aquatic plants should be controlled, photosynthesis should be supported by making adequate use of quality daylight, and the amounts of CO_2 and O_2 in the system should be kept in balance. Accordingly, it is important to use appropriate lighting systems with wavelengths close to daylight in aquariums located in regions that receive insufficient daylight (Bütünoğlu, 2018).

The color of light is determined by the wavelength of the light. Light sources with a wide range from 380 nm to 840 nm are used in plant cultivation. These wavelength ranges of growth periods and their effects on plant development can be listed as follows (Bartucca, et al., 2020):

-It is the ultraviolet lights corresponding to the range of 380 nm-390 nm that guide the flowering of plants.

-Violet blue colored lights corresponding to the range of 400-410 nm support the green leaf development of the plant.

-Blue light in the range of 440-460 nm promotes root growth and green leaf growth.

-Yellow light corresponding to the range of 585-595 nm improves the taste by increasing the nutritional content and trace elements of the plant.

-Red light corresponding to the range of 660-670 nm supports the photosynthesis and photoperiod of the plant.

-Dark red light, corresponding to the range of 730-840 nm, supports the growth and flowering performance of the plant and therefore the productivity of the plant.

Apparently, many different colored lights are used by plant breeders to change the growth rate of the plant, the taste, color of the fruit and leaf, and many other characteristics. It is obvious that plants use this energy from red and blue light sources to grow by absorbing these lights rather than reflecting them. Red light is mainly responsible for the plant's flowering and fruit production. In addition, red light is needed for seed germination, root growth and bulb development of the plant. For this reason, red light in the wavelength range of 600-700 nm is used to support the development of the plant and improve the taste of the fruit. Blue light supports the production of chlorophyll, the most active pigment that supplies photosynthesis in plants. Therefore, the plants that receive plenty of blue light in the 400-500 nm wavelength will have strong, durable and healthy stems and leaves.

Outdoor plants can receive adequate amounts of both red and blue light under natural light. In interior spaces, deficiencies may occur in certain parts of the color spectrum. If the stem of the plant and the parts connecting the leaves to the stem are too long and the leaves lose their green color, it means that it is not receiving enough blue light. If the plant does not bloom when the time comes, it probably lacks red light. While different lamps can be used for red and blue light sources, special light sources can also be used as combined light sources in mixed red and blue light.

In summary, when the right light source is used, it is possible to grow many types of vegetables and fruits, regardless of the season, even on the coldest winter day. In this context, it is possible to accurately adjust the amount of light in different colors, as well as to ensure the adequate and vitality-supporting development of the plants in the aquarium environment and the oxygen balance in the water. Using the right light sources, even in aquariums in dimly lit environments, will support both the quality growth of the plants in the aquarium and the continuation of living life. As a result, balancing the amount of oxygen in the water and using the right light source is of vital importance for both the aquarium plants and the creatures living in that system, so the balance of all parameters in the aquarium system must be maintained in order to ensure the quality of life of every creature.

3. CONCLUSION AND SUGGESTIONS

Art that paves the way for raising awareness about ecosystem destruction holds the potential to highlight the importance of biodiversity, preserve water ecosystem health, and create a sensitivity to

nature. Aquascaping, aimed at reinterpreting natural landscapes and providing a new perspective on landscape design, has also been considered as an art field to be taken into account in this study.

Aquascaping has the potential to artistically preserve areas facing the threat of destruction and extinction in nature, ensuring their transmission to future generations. Through its designs inspired by nature, aquascaping will enable us to confront and engage with the lost natural world by serving as a form of memory.

Designs that mimic nature can also be regarded as a critique of ecological destruction in the future. Depictions that evolve between today and the future will serve as a means to convey ecosystem damages. Aquascaping designs integrated into spaces will artistically highlight the contrast between the depicted and existing natural landscapes.

Aquascaping landscape designs not only make it possible to observe nature indoors but also play a role in introducing aquatic plants. This is significant in terms of the biological diversity that is currently at risk.

In this context, aquascaping, which makes underwater life visible and integrates different concepts with the aquatic ecosystem, can be considered beyond a hobby. Furthermore, it is believed that social activities such as underwater design competitions included in the study could be beneficial for understanding nature and gaining ecological awareness.

As a result of the literature review conducted during this study, which is an evaluation of aquascaping, which is thought to contribute to the promotion of aquatic plant existence in Turkey and raising awareness about the aquatic ecosystem, it has been determined that there is a serious resource deficit in our country. In this context, it is thought that it would be beneficial to include aquascaping studies in landscape education in order to introduce the endemic aquatic plant existence determined by academic studies in our country.

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